

**WHAT IS CLAIMED IS:**

1. A method for detecting a target comprising:
  - (a) contacting the target with a RSP;
  - (b) irradiating the RSP with a source of laser light; and
  - (c) collecting and analyzing a Raman spectra emitted from the RSP;  
wherein the RSP is a small organomolecule or a peptide and the small organomolecule or the peptide binds to the target in step (a).
2. The method of claim 1 wherein, the RSP is not complexed to the target in step (b).
3. The method of claim 1 wherein, the RSP is complexed with the target in step (b).
4. The method of claim 1 wherein, the target is used to diagnose a disease.
5. The method of claim 1 wherein, the target is present in an analytical sample obtained from a source selected from the group consisting of water, food, soil, plant material, and air.
6. The method of claim 1, wherein the RSP is a small organomolecule.
7. The method of claim 1, wherein the RSP comprises a chemical functional group selected from cyano, nitro, amide, ester, ether, olefin, sulphoxide, sulphite, sulphinic acid, sulphinic ester, sulphone, sulphonamide, thiol, carboxylic acid, or alkynyl group.
8. The method of claim 1, wherein the RSP is a peptide
9. A method as defined in claim 1, wherein the Raman spectra is selected from CARS, SERRS, or SERS.
10. A method of preparing an RSP, comprising:
  - (a) selecting a ligand for use as an RSP by a process comprising:
    - (i) combining in solution a ligand with a target sample under saturating binding-reaction conditions to yield a mixture containing a target-ligand complex;
    - (ii) analyzing the target-complex; and
    - (iii) elucidating the ligand's structure; and
  - (b) preparing the RSP by:
    - (i) synthesizing the selected ligand if the structure contains a distinguishable Raman signal; or
    - (ii) synthesizing analog of the ligand if the ligand does not contain distinguishable Raman signal.
11. A method as defined in claim 10, wherein the ligand is a small organomolecule.

12. A method as defined in claim 10, wherein ligand or the analog of the ligand comprises at least one cyano, nitro, amide, ester, ether, olefin, sulphoxide, sulphite, sulphinic acid, sulphinic ester, sulphone, sulphonamide, thiol, carboxylic acid, or alkynyl group.
13. A method as defined in claim 10, further comprising performing a screening process a plurality of times in a parallel, high-throughput manner with different ligands to select the ligand for use as an RSP.
14. A method as defined in claim 10, wherein mass spectrometry is used to analyze the isolated complex.
15. A method as defined in claim 10, wherein the screening process further comprises purifying the isolated complex prior to the analyzing.
16. A method as defined in claim 10, wherein the target-ligand complex is isolated and then analyzed.
17. A method as defined in claim 10, wherein the elucidating of the ligand's structure is performed before the combining with the target sample.
18. A method as defined in claim 10, wherein the elucidating is performed after the analyzing and comprises locating the ligand in a well of a library plate or array having a plurality of wells each containing a ligand resulting from a combinatorial reaction, and identifying the structure of the expected product of the combinatorial reaction.
19. A method as defined in claim 10, further comprising:
  - (c) using the RSP as an imaging reagent in a process comprising:
    - (i) administering the RSP to a subject;
    - (ii) obtaining a biological sample from the subject; and
    - (iii) quantitatively detecting for the presence of the RSP in the biological sample.
20. A method as defined in claim 19, wherein the quantitatively detecting is performed using Raman spectroscopy.
21. A method as defined in claim 19, wherein the quantitatively detecting is performed using CARS, SERRS, or SERS.
22. A method of preparing an RSP, comprising:
  - (a) selecting a small organomolecule for use as an RSP by a process comprising:
    - (i) combining in solution a small organomolecule with a target sample under saturating binding-reaction conditions to yield a mixture containing a target-small organomolecule complex;

(ii) analyzing the target-small organomolecule complex using mass spectrometry; and

(iii) elucidating the small organomolecule's structure; and

(b) preparing the RSP by:

(i) synthesizing the selected small organomolecule if the structure contains at least one cyano, nitro, amide, ester, ether, olefin, sulphoxide, sulphite, sulphonic acid, sulphonic ester, sulphone, sulphonamide, thiol, carboxylic acid, or alkynyl group; or

(ii) synthesizing a cyano, nitro, amide, ester, ether, olefin, sulphoxide, sulphite, sulphonic acid, sulphonic ester, sulphone, sulphonamide, thiol, carboxylic acid, or alkynyl group analog of the small organomolecule if the structure does not contain any cyano, nitro, amide, ester, ether, olefin, sulphoxide, sulphite, sulphonic acid, sulphonic ester, sulphone, sulphonamide, thiol, carboxylic acid, or alkynyl group.

23. A method as defined in claim 22, further comprising performing a screening process a plurality of times in a parallel, high-throughput manner with different ligands to select the ligand for use as an RSP.

24. A method as defined in claim 22, wherein the screening process further comprises purifying the isolated complex prior to the analyzing.

25. A method as defined in claim 22, wherein the ligand is a small organomolecule.

26. A method as defined in claim 22, further comprising:

(c) using the RSP as an imaging reagent in a process comprising:

(i) administering the RSP to a subject;

(ii) obtaining a biological sample from the subject; and

(iii) quantitatively detecting for the presence of the RSP in the biological

sample.

27. A method as defined in claim 26, wherein the quantitatively detecting is performed using Raman spectroscopy.

28. A method as defined in claim 26, wherein the quantitatively detecting is performed using CARS, SERRS, or SERS.

29. A method of converting a small organomolecule for use as an RSP, comprising:

(a) identifying a small organomolecule;

(b) synthesizing the small organomolecule if the small organomolecule contains a distinguishable Raman signal; or

(c) synthesizing an analog of the small organomolecule if the small organomolecule does not contain a distinguishable Raman signal.

30. A method as defined in claim 29, wherein the small organomolecule or the analog of the small organomolecule has one or more groups selected from cyano, nitro, amide, ester, ether, olefin, sulphoxide, sulphite, sulphinic acid, sulphinic ester, sulphone, sulphonamide, thiol, carboxylic acid, or alkynyl group.

31. A method as defined in claim 29, further comprising:

(c) using the RSP as an imaging reagent in a process comprising:

(i) administering the RSP to a subject;

(ii) obtaining a biological sample from the subject; and

(iii) quantitatively detecting for the presence of the RSP in the biological sample.

32. A method as defined in claim 31, wherein the quantitatively detecting is performed using Raman spectroscopy.

33. A method as defined in claim 31, wherein the quantitatively detecting is performed using CARS, SERRS, or SERS.

34. A method for detecting a target comprising:

(a) contacting the target with an RSP of claim 10;

(b) irradiating the target with a laser; and

(c) collecting and analyzing Raman spectra emitted from the target.

35. A method for detecting a target comprising:

(a) contacting the target with an RSP of claim 22;

(b) irradiating the target with a laser; and

(c) collecting and analyzing Raman spectra emitted from the target.

36. A method for detecting a target comprising:

(a) contacting the target with an RSP of claim 29;

(b) irradiating the target with a laser; and

(c) collecting and analyzing Raman spectra emitted from the target.